# Ice Age DA

## Uniqueness

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#### **Uni/Link: Ice age coming- Earth in interglacial cycle- carbon key to survival** Jackson 14 (Steven T. Jackson, PhD Ecology, Professor Emeritus of Paleoecology at the University of Wyoming, “climate change” Encyclopedia Britannica Academic) <http://www.britannica.com/EBchecked/topic/121632/climate-change/275791/Glacial-and-interglacial-cycles-of-the-Pleistocene> NCThe glacial period that peaked 21,500 years ago was only the most recent of five glacial periods in the last 450,000 years. In fact, the Earth system has alternated between glacial and interglacial regimes for more than two million years, a period of time known as the Pleistocene. The duration and severity of the glacial periods increased during this period, with a particularly sharp change occurring between 900,000 and 600,000 years ago. Earth is currently within the most recent interglacial period, which started 11,700 years ago and is commonly known as the Holocene Epoch.¶ The continental glaciations of the Pleistocene left signatures on the landscape in the form of glacial deposits and landforms; however, the best knowledge of the magnitude and timing of the various glacial and interglacial periods comes from oxygen isotope records in ocean sediments. These records provide both a direct measure of sea level and an indirect measure of global ice volume. Water molecules composed of a lighter isotope of oxygen, 16O, are evaporated more readily than molecules bearing a heavier isotope, 18O. Glacial periods are characterized by high 18O concentrations and represent a net transfer of water, especially with 16O, from the oceans to the ice sheets. Oxygen isotope records indicate that interglacial periods have typically lasted 10,000–15,000 years, and maximum glacial periods were of similar length. Most of the past 500,000 years—approximately 80 percent—have been spent within various intermediate glacial states that were warmer than glacial maxima but cooler than interglacials. During these intermediate times, substantial glaciers occurred over much of Canada and probably covered Scandinavia as well. These intermediate states were not constant; they were characterized by continual, millennial-scale climate variation. There has been no average or typical state for global climate during Pleistocene and Holocene times; the Earth system has been in continual flux between interglacial and glacial patterns.¶ The cycling of the Earth system between glacial and interglacial modes has been ultimately driven by orbital variations. However, orbital forcing is by itself insufficient to explain all of this variation, and Earth system scientists are focusing their attention on the interactions and feedbacks between the myriad components of the Earth system. For example, the initial development of a continental ice sheet increases albedo over a portion of Earth, reducing surface absorption of sunlight and leading to further cooling. Similarly, changes in terrestrial vegetation, such as the replacement of forests by tundra, feed back into the atmosphere via changes in both albedo and latent heat flux from evapotranspiration. Forests—particularly those of tropical and temperate areas, with their large leaf area—release great amounts of water vapour and latent heat through transpiration. Tundra plants, which are much smaller, possess tiny leaves designed to slow water loss; they release only a small fraction of the water vapour that forests do.¶ The discovery in ice core records that atmospheric concentrations of two potent greenhouse gases, carbon dioxide and methane, have decreased during past glacial periods and peaked during interglacials indicates important feedback processes in the Earth system. Reduction of greenhouse gas concentrations during the transition to a glacial phase would reinforce and amplify cooling already under way. The reverse is true for transition to interglacial periods. The glacial carbon sink remains a topic of considerable research activity. A full understanding of glacial-interglacial carbon dynamics requires knowledge of the complex interplay among ocean chemistry and circulation, ecology of marine and terrestrial organisms, ice sheet dynamics, and atmospheric chemistry and circulation

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### AT-Non-unique

#### **Earth in interglacial now- Ice Age coming**

National Oceanic and Atmospheric Administration 08 (NOAA, 8-20-08, “A Paleo Perspective on Abrupt Climate Change,” <http://www.ncdc.noaa.gov/paleo/abrupt/data2.html> NC

Large, continental ice-sheets in the Northern Hemisphere have grown and retreated many times in the past. Times with large ice-sheets are known as glacial periods (or ice ages) and times without large ice-sheets are interglacial periods. The most recent glacial period occurred between about 120,000 and 11,500 years ago. Since then, the Earth has been in an interglacial period called the Holocene (Figure 2). Glacial periods are colder, dustier and generally drier than interglacial periods. These glacial-interglacial cycles are apparent in many marine and terrestrial paleoclimate records from around the world. Variations in the Earth's orbit through time have changed the amount of solar radiation received by the Earth in each season (Figure 3). Interglacial periods, shown as the periods of higher temperature (shaded in yellow) in the Dome Fuji ice core from Antarctica, tend to happen during times of more intense summer solar radiation in the Northern Hemisphere. These glacial-interglacial cycles have waxed and waned throughout the Quaternary Period (the past 1.8 million years). Since the middle Quaternary, glacial-interglacial cycles have had a frequency of about 100,000 years. In the solar radiation time-series, cycles of this length (known as "eccentricity") are present but are weaker than cycles lasting about 23,000 years, (which are called "precession of the equinoxes.") Interglacial periods tend to occur during periods of peak solar radiation in the Northern Hemisphere summer. As you can see in Figure 3, however, full interglacials occur only about every fifth peak in the precession cycle. The full explanation for this observation is still an active area of research. Non-linear processes such as positive feedbacks within the climate system must also be very important in determining when glacial and interglacial periods occur.¶ Another interesting fact shown in Figure 3 is that temperature variations in Antarctica are in phase with solar radiation changes in the high northern latitudes. Solar radiation changes in the high southern latitudes near Antarctica are actually out-of-phase with temperature changes, such that the coldest period during the most recent ice age occurred at about the time the region was experiencing a peak in local sunshine. This means that the growth of ice sheets in the Northern Hemisphere has an important influence on climate worldwide.

#### Earth currently in interglacial cycle

**Eldredge and Biek 10** (Sandy Eldredge and Bob Biek, Geologic Manager and Information Specialist, Geologist, September 2010, “Ice Ages – What are they and what causes them,” Utah Geological Survey, http://geology.utah.gov/surveynotes/gladasked/gladice\_ages.htm NC **What is an ice age? An ice age is a long interval of time (millions to tens of millions of years) when global temperatures are relatively cold and large areas of the Earth are covered by continental ice sheets and alpine glaciers.** Within an ice age are multiple shorter-term periods of warmer temperatures when glaciers retreat **(called interglacials** **or interglacial cycles)** and colder temperatures when glaciers advance **(called glacials or glacial cycles).**¶ **At least five major ice ages have occurred throughout Earth’s history: the earliest was over 2 billion years ago, and the most recent one began approximately 3 million years ago and continues today (yes, we live in an ice age!).**¶Currently, we are in a warm interglacial that began about 11,000 years ago**.** The last period of glaciation**, which is often informally called the “Ice Age,”** peaked about 20,000 years ago**. At that time,** the world was on average **probably** about **10°F** (5°C) colder than today**,** and locally as much as **40°F** (22°C) colder**.**

#### Glacial cycles caused by continental and orbital shift

**Eldredge and Biek 10** (Sandy Eldredge and Bob Biek, Geologic Manager and Information Specialist, Geologist, September 2010, “Ice Ages – What are they and what causes them,” Utah Geological Survey, <http://geology.utah.gov/surveynotes/gladasked/gladice_ages.htm> NC

Many factors contribute to climate variations, including changes in ocean and atmosphere circulation patterns, varying concentrations of atmospheric carbon dioxide, and even volcanic eruptions. The following discusses key factors in (1) initiating ice ages and (2) the timing of glacial-interglacial cycles.¶ One significant trigger in initiating ice ages is the changing positions of Earth’s ever-moving continents, which affect ocean and atmospheric circulation patterns. When plate-tectonic movement causes continents to be arranged such that warm water flow from the equator to the poles is blocked or reduced, ice sheets may arise and set another ice age in motion.¶ Today’s ice age most likely began when the land bridge between North and South America (Isthmus of Panama) formed and ended the exchange of tropical water between the Atlantic and Pacific Oceans, significantly altering ocean currents.¶ Glacials and interglacials occur in fairly regular repeated cycles. The timing is governed to a large degree by predictable cyclic changes in Earth’s orbit, which affect the amount of sunlight reaching different parts of Earth’s surface. The three orbital variations are: (1) changes in Earth’s orbit around the Sun (eccentricity), (2) shifts in the tilt of Earth’s axis (obliquity), and (3) the wobbling motion of Earth’s axis (precession).

#### Temperatures going to change- empirics prove

**Eldredge and Biek 10** (Sandy Eldredge and Bob Biek, Geologic Manager and Information Specialist, Geologist, September 2010, “Ice Ages – What are they and what causes them,” Utah Geological Survey, <http://geology.utah.gov/surveynotes/gladasked/gladice_ages.htm> NC

Records show that ice ages typically develop slowly, whereas they end more abruptly. Glacials and interglacials within an ice age display this same trend.¶ On a shorter time scale, global temperatures fluctuate often and rapidly. Various records reveal numerous large, widespread, abrupt climate changes over the past 100,000 years. One of the more recent intriguing findings is the remarkable speed of these changes. Within the incredibly short time span (by geologic standards) of only a few decades or even a few years, global temperatures have fluctuated by as much as 15°F (8°C) or more.¶ For example, as Earth was emerging out of the last glacial cycle, the warming trend was interrupted 12,800 years ago when temperatures dropped dramatically in only several decades. A mere 1,300 years later, temperatures locally spiked as much as 20°F (11°C) within just several years. Sudden changes like this occurred at least 24 times during the past 100,000 years. In a relative sense, we are in a time of unusually stable temperatures today—how long will it last?

#### The increase of sea ice

Ambler 14 (Harold Ambler, Writer, 6-29-14, “Antarctica sets new record for sea ice”, talking about the weather, <http://talkingabouttheweather.wordpress.com/2014/06/29/antarctica-sets-new-record-for-sea-ice/>) EX

Antarctica sets new record for sea ice. The sea ice surrounding Antarctica, which, as I reported in my book, has been steadily increasing throughout the period of satellite measurement that began in 1979, has hit a new all-time record high for areal coverage. The new record anomaly for Southern Hemisphere sea ice, the ice encircling the southernmost continent, is 2.074 million square kilometers and was posted for the first time by the University of Illinois at Urbana-Champaign’s The Cryosphere Today early Sunday morning.It was not immediately apparent whether the record had occurred on Friday or Saturday. Requests for comment to Bill Chapman, who runs The Cryosphere Today, were not immediately returned. The previous record anomaly for Southern Hemisphere sea ice area was 1.840 million square kilometers and occurred on December 20, 2007.Global sea ice area, as of Sunday morning, stood at 0.991 million square kilometers above average. (The figure was arrived at by adding the Northern Hemisphere anomaly and the Southern Hemisphere anomaly. A graph provided by The Cryosphere Today showed the global anomaly as 1.005 million square kilometers.)Although early computer models predicted a diminishment of both Northern Hemisphere and Southern Hemisphere sea ice due to anthropogenic global warming, subsequent modeling has posited that the results of warming around Antarctica would, counter-intuitively, generate sea ice growth.The steady growth of Antarctic sea ice and its influence on global sea ice appeared to provide a public relations problem, at a minimum, for those warning of global warming’s menace.

#### Unusual sun cooling

**Hurd 14** (Dale Hurd, CBN News Sr. Reporter, 1-8-14, “Global Cooling: Is an Ice Age Coming?”, CBN News,<http://www.cbn.com/cbnnews/healthscience/2014/January/Cover-Up-Mounting-Evidence-Belies-Global-Warming/>) EX

The fact that *Arctic ice is growing may not be the good news that it seems*  to be. There are signs that *the Earth is entering a very unpleasant cooling period*. *Sunspot activity remains very low*."*The sun has been very unusual for almost 15 years* now," Jens Pedersen, senior scientist at the Denmark's Technical University, said.Pedersen said *the sun recently reached solar maximum and that there should be a lot of sunspot activity, but there isn't*."We have to go back 100 years to find a solar maximum that was as weak as the one we are in right now," he told CBN News. "And the recent solar minimum…one has to go back 200 years to find one that was as weak."*The last time the sun was this quiet, North America and Europe suffered through a weather event* *from the 1600s to the 1800s known as "Little Ice Age*," when the Thames River in London regularly froze solid, and North America saw terrible winters. Crops failed and people starved.

#### Defense- Scientists aren’t telling the truth

**Hurd 14** (Dale Hurd, CBN News Sr. Reporter, 1-8-14, “Global Cooling: Is an Ice Age Coming?”, CBN News, <http://www.cbn.com/cbnnews/healthscience/2014/January/Cover-Up-Mounting-Evidence-Belies-Global-Warming/>) EX

Pedersen said climate scientists know the Earth stopped warming 15 years ago. But the United Nations Intergovernmental Panel on Climate Change, of which Pedersen is an expert reviewer, suppressed a recent report from its own scientists that the U.N.'s climate model has been proven wrong."In particular one of the issues has been why global warming has stopped during the last 15 years, and climate scientists were very frank that the climate models do not match the climate we observe," Pedersen said. But politicians removed that embarrassing finding from the final draft.  It's as if the alleged danger from climate change can't be wrong because it is now too important .It has become a political movement, a cash cow for climate scientists and environmental groups, and a way for world leaders to control economies and people." It's a political agenda," Dan Gainor, vice president of business and culture at the Media Research Center, said. "When you look at what the government will be able to do with climate change, it gives them (access) into every aspect of our lives."

#### Unusual solar lull – Could cause mini ice age

Ruble 14 (Kimberly Ruble, writer for Liberty Voice, “Scientists Believe Sun is ‘Falling Asleep’ and Mini Ice Age on Way”, Liberty Voice) SC

<http://guardianlv.com/2014/02/scientists-believe-sun-is-falling-asleep-and-mini-ice-age-on-way/>

Richard Harrison, who is the lead of space physics at a laboratory in Oxfordshire, England is worried because our Sun appears to be falling asleep and a mini ice age could be on the way for the Earth. He states that he has been a solar physicist for nearly three decades, and he has never saw the sun do anything quite like what it is doing now. The Sun is very inactive, so much so that one would have to go back around 100 years to compare the difference. Such a solar lull is totally baffling to other scientists as well because the Sun should be full of activity right now. It seems that the Sun’s activity might be dropping faster than at any time in the past 10,000 years. It had hit a solar maximum, the point in its 11-year cycle where activity is supposed to hit a peak. Therefore, our personal star should be covered with sunspots, setting off flares and discharging large clouds of particles out into space in the form of coronal ejections. Researchers state that the decline is unusually rapid. There is no way to know what the total consequences of a quieting Sun will be, one thing the scientists are positive about is that the Earth’s star is extremely unpredictable, and anything might occur next. Yes our Sun appears to be falling asleep and a mini ice age is most likely on the way.

#### Global warming melting the ice caps is biased and cannot be predicted by the time ice age occurs

**Maglio 14** (Domenick J. Maglio, Traditional Realist, 7-17-14, “The Irony of Climate Change Predictions”, Hernando Today <http://hernandotoday.com/he/list/hernando-columns/maglio-the-irony-of-climate-change-predictions-20140717/>) SC

Scientific prediction after prediction of global warming that does not materialize is conveniently ignored. In the early 1970s scientists were talking about global warming. By 1974 they were writing of the coming Ice Age.  In the 1990s Al Gore and other politicos were predicting the ice would melt, raising ocean levels, killing polar bears and leaving the world’s most populated coastal areas underwater. In 2007 the BBC stated that the arctic would be iceless by 2013. But satellite data from the U.S. National Snow and Ice Data Center and European Space Agency have shown ice is thicker in the arctic than it was five years ago.   Jerry Brown, governor of California, stated on May 13 that LAX would be underwater within 200 years although the airport is 125 feet above sea level.  Even NOAA said, “it would take 45,903.6 years to reach 125 feet at the present rate of global warming, we’d be in a new ice age by then and sea levels would be falling.”There is numerous fear mongering studies blaming every disaster and anti-social behavior on CO2 emissions.  Hurricanes — increases in or lack of — tornados, mudslides, fires, drought, cold spells and heat waves are promoted as definitive signs of global warming, change, or disruption.Terrorism, domestic violence, general crime, wars and birth rates have been noted by proponents of global warming to have increased or will continue to escalate due to global warming.  These so-called expert “studies” and the federal government through grants, which drives these absurd claims exponentially, incentivizes articles supporting global warming.

## **Links**

Greenhouse Gas Emmissions prevent ice age

Vieru, 14 (Tudor. "Global Warming Prevents New Ice Age from Ocurring" KBJ

It's common knowledge among climate scientists that ice ages occur regularly on Earth. Multi-millennial winters set in about once every 11,000 years or so, and the latest one failed to start. Scientists believe that global warming and climate change are responsible for the current state of affairs.¶ The last ice age that occurred on schedule took place about 11,600 years ago, so we're already more than half of a millennium late for the next one. According to experts, it could be that this natural cycle will stop now, primarily because of the vast amounts of pollutants we are releasing into the atmosphere.¶ Carbon dioxide, methane and other greenhouse gases are warming up the planet, putting a dent in various natural cycles. Apparently, the phenomenon is also influencing processes we had no idea were susceptible to such changes.¶ At this point, figuring out what the latest discovery means is still far away, since the issue is complex. Scientists need to analyze the implications of their findings in a holistic manner, meaning that they need to look at multiple systems – and how they relate – at the same time. ¶ A team of experts from the University of Cambridge, in the United Kingdom, published a research paper in this week's issue of the top journal Nature Geoscience, highlighting how the next ice age would have occurred if CO2 concentrations were normal, and if we weren't around to influence it.¶ Through complex simulations, the researchers were able to determine that the ice age would start in the next 1,000 years, no later. While this may seem like a lot to us, it's in fact a very brief period of geologic time, from our planet's perspective. ¶ The new study was also able to discover what experts call glacial inception, or the signature of how an ice age gets activated. The main way they went about doing so was to analyze temperature contrasts developing between Greenland and Antarctica.¶ “The mystery of the ice ages, which represent the dominant mode of climate change over the past few million years, is that while we can identify the various ingredients that have contributed to them, it’s the arrangement of these ingredients, and how they march to the beat of subtle changes in seasonality, that we lack an understanding of,” Dr Luke Skinner explains. ¶ The expert, who holds an appointment as a professor at the Cambridge Department of Earth Sciences, led the work with professor David Hodell, also from Cambridge, and University College London (UCL) colleague, professor Chronis Tzedakis.

#### Global Warming is helping to stop the next Ice Age

**Cocks,** 12/21/20**09,** Professor at Duke University, “Will the greenhouse effect prevent the return of glaciers,” <http://www.technologyreview.com/article/416786/global-warming-vs-the-next-ice-age/> **AP**

Global warming is an inescapable issue for our age. But 180 years ago, most scientists believed that Earth had been steadily cooling since it was formed. When Louis Agassiz presented the concept of a Great Ice Age to the Swiss Society of Natural Sciences in 1837, his suggestion that the planet had turned colder and then warmed up again was met with skepticism and even hostility, triggering years of fierce scientific debate before the idea was accepted.

Exactly why our planet occasionally cools down has taken more than a century to work out. Now we know that cyclic gravitational tugs from Jupiter and Saturn periodically elongate Earth’s orbit, and this effect combines from time to time with slow changes in the direction and degree of Earth’s tilt that are caused by the gravity of our large moon. Consequently, summer sunlight around the poles is reduced, and high-latitude regions such as Alaska, northern Canada, and Siberia turn cold enough to preserve snow year-round. This constant snow cover reflects a great deal of sunlight, cooling things down even more, and a new ice age begins. Naturally, this process does not occur with anything like the speed portrayed in the movie The Day After Tomorrow, but geological and other evidence shows that it’s happened at least four times.

With so much attention focused on global warming, this chilly prospect has been all but forgotten. Given how catastrophic another ice age could be, one might be tempted to ask whether a human-caused increase in atmospheric and ocean temperatures will actually be a boon.

**Increased greenhouse gases stalls new ice age cycle**

StephanVavrus**,** John Kutzbach**,** University of Wisconsin-Madison, **08** ("Did Early Global Warming Divert A New Ice Age?" http://www.sciencedaily.com/releases/2008/12/081217190433.htm)KBJ

What's more, according to the same computer simulations, **the** cumulative **effect of** thousands of years of **human influence on climate is preventing the world from entering a new glacial age,** altering a clockwork rhythm of periodic cooling of the planet that extends back more than a million years.

"This challenges the paradigm that things began changing with the Industrial Revolution," says Stephen Vavrus, a climatologist at the University of Wisconsin-Madison's Center for Climatic Research and the Nelson Institute for Environmental Studies. "If you think about even a small rate of increase over a long period of time, it becomes important."

Addressing scientists on Dec 17 at a meeting of the American Geophysical Union, Vavrus and colleagues John Kutzbach and Gwenaëlle Philippon provided detailed evidence in support of a controversial idea first put forward by climatologist William F. Ruddiman of the University of Virginia. That idea, debated for the past several years by climate scientists, holds that **the introduction of large-scale** rice **agriculture** in Asia, **coupled with extensive deforestation** in Europe **began to alter world climate by pumping significant amounts of greenhouse gases** — methane from terraced rice paddies and carbon dioxide from burning forests — **into the atmosphere.** In turn, **a warmer atmosphere heated the oceans making them** much **less efficient storehouses of carbon dioxide and reinforcing global warming.**

**That** one-two punch, say Kutzbach and Vavrus, **was enough to set human-induced climate change in motion.**

"No one disputes the large rate of increase in greenhouse gases with the Industrial Revolution," Kutzbach notes. "The large-scale burning of coal for industry has swamped everything else" in the record.

But looking farther back in time, using climatic archives such as 850,000-year-old ice core records from Antarctica, scientists are teasing out evidence of past greenhouse gases in the form of fossil air trapped in the ice. That ancient air, say Vavrus and Kutzbach, contains the unmistakable signature of increased levels of atmospheric methane and carbon dioxide beginning thousands of years before the industrial age.

"Between 5,000 and 8,000 years ago, both **methane and carbon dioxide started an upward trend**, unlike during previous interglacial periods," explains Kutzbach. Indeed, Ruddiman has shown that **during the latter stages of six previous interglacials, greenhouse gases trended downward, not upward**. Thus, **the accumulation of greenhouse gases over the past few thousands of years**, the Wisconsin-Virginia team argue, **is** very likely **forestalling** the onset of **a new glacial cycle,** such as have occurred at regular 100,000-year intervals during the last million years. Each glacial period has been paced by regular and predictable changes in the orbit of the Earth known as Milankovitch cycles, a mechanism thought to kick start glacial cycles.

"We're at a very favorable state right now for increased glaciation," says Kutzbach. "Nature is favoring it at this time in orbital cycles, and if humans weren't in the picture it would probably be happening today."

Importantly, **the new research underscores the key role of greenhouse gases in influencing Earth's climate.** Whereas decreasing greenhouse gases in the past helped initiate glaciations, **the early** agricultural **and recent** industrial **increases in greenhouse gases may be forestalling them,** say Kutzbach and Vavrus.

Using three different climate models and removing the amount of greenhouse gases humans have injected into the atmosphere during the past 5,000 to 8,000 years, Vavrus and Kutzbach observed more permanent snow and ice cover in regions of Canada, Siberia, Greenland and the Rocky Mountains, all known to be seed regions for glaciers from previous ice ages. **Vavrus notes: "With every feedback we've included, it seems to support the hypothesis (of a forestalled ice age) even more. We keep getting the same answer."**

#### Reversing warming will start the next Ice Age

**Wilson and Watson, 4/21/2006**, Writers for HowStuffWorks, “Could reversing global warming start an ice age,” <http://science.howstuffworks.com/environmental/green-science/question7801.htm> **AP**

According to one school of thought, a warming planet is one that's less likely to wind up in an [ice age](http://geography.howstuffworks.com/terms-and-associations/ice-age.htm). Because the [Earth](http://science.howstuffworks.com/environmental/earth/geophysics/earth.htm) is always going through warming and cooling cycles, and we've been in one of the warming cycles for about 12,000 years now, scientists say it's inevitable that we'll hit another big chill sometime in the next 10,000 to 100,000 years. If that happens, much of the world -- including Europe and North America -- would be covered in a thick sheet of ice. According to some researchers, the heat trapped in the Earth's atmosphere from the greenhouse effect will offset this cooling -- essentially preventing the Earth from entering another ice age [sources: [Science Daily](http://www.sciencedaily.com/releases/2008/12/081217190433.htm), [Cosmos](http://www.cosmosmagazine.com/node/2305/full)].

**Global Warming prevents the next Ice Age**

**France-Presse, 08**

(Agence. "Global Warming to stave off Ice Age" <http://cosmosmagazine.com/news/global-warming-may-stave-ice-age/>) KBJ

**Earth has experienced long periods of extreme cold over the billions of years of its history. The big freezes are interspersed with “interglacial” periods of relative warmth, of the kind we have experienced since the end of the last Ice Age, around 11,000 years ago. ¶**These climate swings have natural causes, believed to be rooted particularly in changes in Earth’s orbit and axis that, while minute, have a powerful effect on how much solar heat falls on the planet. The two researchers behind the study built a high-powered computer model to take a closer look at these intriguing phases of cooling and warmth. In addition to the planetary shifts, they also factored in levels of carbon dioxide (CO2), found in tiny bubbles in ice cores, that provide an indicator of temperature spanning hundreds of thousands of years. The model revealed dramatic swings in climate, including changes when Earth flipped from one state to the other over a relatively short time, said one of the authors, geoscientist Thomas Crowley of the University of Edinburgh in Scotland. These shifts, called “bifurcations,” appear to happen in abrupt series, which is counter-intuitive to the idea that the planet cools or warms gradually. “You had a big change about a million years ago; then a second change around 650,000 years ago, when you had bigger glaciations; then 450,000 years ago, when you started to get more repeated glaciations,” said Crowley. “What’s also interesting is that the inter-glaciations also became warmer.” According to the model, authored by Crowley and physicist William Hyde of Toronto University in Canada, the next “bifurcation” would normally be due between 10,000 and 100,000 years from now. The chill would likely induce a long, stable period of glaciation in the mid-latitudes, smothering Europe, Asia and North America to about 45 to 50º latitude with a thick sheet of ice. However, there is now so much CO2 in the air, as a result of fossil-fuel burning and deforestation, that this adds a heat-trapping greenhouse effect that will offset the cooling impacts of orbital shift, said Crowley.“Even the level that we have there now is more than sufficient to reach that critical state seen in the model,” he said. “If we cut back [on CO2] some, that would probably still be enough.” In September, a scientific research consortium called the Global Carbon Project (GCP) said that atmospheric concentrations of CO2 reached 383 parts per million (ppm) in 2007, or 37 per cent above pre-industrial levels. Present concentrations are “the highest during the last 650,000 years and probably during the last 20 million years,” the report said.

**Ice Age prevented by climate change**

09 Jan 2012, 18:28 Verity Payne, <http://www.carbonbrief.org/blog/2012/01/lethal-ice-age-prevented-by-climate-change/>

The Nature Geoscience paper: Man-made emissions may delay ice age It's thought that ice ages are triggered by small changes in the Earth's orbit around the sun. The pattern of these changes indicate that another ice age might begin in around 1,500 years. However, scientists have now found that man-made greenhouse gas emissions are warming the Earth enough to prevent it from responding in the way that it has over the last million years. Professor Jim Channell, University of Florida, one of the report's co-authors, explains: "We know from past records that Earth's orbital characteristics during our present interglacial period are a dead ringer for orbital characteristics in an interglacial period 780,000 years ago." Scientists would expect the Earth to behave in a similar way to that period, but human greenhouse gas emissions may have disrupted the normal glaciation cycle. As Channell puts it: "The problem is that now we have added to the total amount of CO2 cycling through the system by burning fossil fuels, the cooling forces can't keep up."

#### Global Warming prevents ice age

Discovery Channel, Date not specified

http://curiosity.discovery.com/question/global-warming-prevent-ice-age

The Earth experiences cycles of warming and cooling. The cooling cycles often lead to extremely cold temperatures that cause ice ages. Some scientists believe that global warming could disrupt these cycles. Gases such as carbon dioxide -- so-called greenhouse gases -- being trapped in the planet's atmosphere cause global warming. These gases trap heat in the atmosphere as well, a phenomenon called the greenhouse effect. The greenhouse effect potentially could prevent the Earth from entering the cooling period necessary for another ice age.

#### Next Ice Age Delayed by Global Warming, Study Says

Christine Dell'Amore, National Geographic News, September 3, 2009, <http://news.nationalgeographic.com/news/2009/09/090903-arctic-warming-ice-age.html> KBJ

Humans are putting the brakes on the next ice age, according to the most extensive study to date on Arctic climate change. Ice Age, Interrupted Earth's angle toward the sun changes due to a natural 26,000-year-long wobble, which causes the planet to spin on is axis like an unstable top, so that a line drawn from the axis would trace a cone in the sky. The wobble causes Earth to make its closest pass by the sun in different months over the long term. For the past 7,000 years, Earth has passed closest to the sun in January. This means less sunlight has been hitting the Arctic during its summertime, so the region should be cooling. (See an Arctic map.) To estimate past temperatures, the research team looked at Arctic lake sediments and at previously published data of glacial ice cores and tree rings. The team also examined a computer model of global climate based at the National Center for Atmospheric Research in Colorado. Miller and colleagues found that the wobble in Earth's tilt causes Arctic temperatures to drop by about 0.36 degree Fahrenheit (0.2 degree Celsius) every thousand years during a cooling phase. But human-caused global warming overwhelmed that gradual cooling in the mid-1990s, shooting temperatures up by about 2.5 degrees Fahrenheit (1.4 degrees Celsius) over the course of a few decades. In fact four of the five warmest decades in the past 2,000 years occurred after 1950, according to the study, which will be published tomorrow in the journal Science. Ecologist Syndonia Bret-Harte said she has seen the effects of climate change firsthand during her research on the changing Alaskantundra. The new study "doesn't seem that surprising, but it's good to confirm what researchers were already thinking," said Bret-Harte, of the Institute of Arctic Biology at the University of Alaska, Fairbanks.

#### Global Warming Could Forestall Ice Age

ANDREW C. REVKIN, September 3, 2009, (<http://www.nytimes.com/2009/09/04/science/earth/04arctic.html?_r=0>) KBJ

Scientists familiar with the work, to be published Friday in the journal Science, said it provided fresh evidence that human activity is not only warming the globe, particularly the Arctic, but could also even fend off what had been presumed to be an inevitable descent into a new ice age over the next few dozen millenniums. The reversal of the slow cooling trend in the Arctic, recorded in samples of layered lakebed mud, glacial ice and tree rings from Alaska to Siberia, has been swift and pronounced, the team writes.

#### Next Ice Age Delayed By Global Warming Gases

**Chestney, 1/9/2012,** Senior Energy and Environment Correspondent, “Next Ice Age Delayed By Global Warming Gases, Study Finds,” <http://www.huffingtonpost.com/2012/01/09/next-ice-age-global-warming_n_1193900.html> **AP**

High levels of carbon dioxide emissions in the atmosphere means the next ice age is unlikely to begin for at least 1,500 years, an article in the journal Nature Geoscience said on Monday. Concentrations of the main gases blamed for global warming reached record levels in 2010 and will linger in the atmosphere for decades even if the world stopped pumping out emissions today, according to the U.N.'s weather agency. An ice age is a period when there is a long-term reduction in the earth's surface and atmospheric temperature, which leads to the growth of ice sheets and glaciers. There have been at least five ice ages on earth. During ice ages there are cycles of glaciation with ice sheets both advancing and retreating. Officially, the earth has been in an interglacial or warmer period, for the last 10,000 to 15,000 years, and estimates vary on how long such periods last. "(Analysis) suggests that the end of the current interglacial (period) would occur within the next 1,500 years, if atmospheric CO2 concentrations do not exceed (around) 240 parts per million by volume (ppmv)," the study said. However, the current carbon dioxide concentration is of 390 ppmv, and at that level an increase in the volume of ice sheets would not be possible, it added. The study based on variations in the earth's orbit and rock samples was conducted by academics at Cambridge University, University College London, the University of Florida and Norway's University of Bergen. The causes of ice ages are not fully understood but concentrations of methane and carbon dioxide in the atmosphere, changes in the earth's orbit around the sun, and the movements of tectonic plates are all thought to contribute. The world is forecast to grow hotter as greenhouse gases continue to rise, increasing threats such as extreme weather events and sea level rise. Scientists have warned that global temperature rise should be limited to within 2 degrees Celsius to avoid the worst effects of climate change but delays in curbing emissions growth are putting the planet at risk.

## Impacts

Ice Age would lead to extinction

Caruba 2008 (Alan Caruba, journalist and chairman of NAC, “Calm Sun, Cold Earth,” Free Republic) <http://www.freerepublic.com/focus/news/1976447/posts>) bc

On February 7, Investors Business Daily had an editorial titled "The Sun Also Sets" in which it cited the views of Kenneth Tapping, a solar researcher and project director for Canada's National Research Council. In essence, Tapping wants people to know that solar activity such as sunspots, i.e., magnetic storms, “has been disturbingly quiet.” It’s useful to know that global temperatures closely reflect solar cycles. The lack of activity “could signal the beginning of what is known as the Maunder Minimum.” While solar cycles tend to last about 11 years, the lack of normal or increased activity can trigger the Maunder Minimum, an event that occurs every few centuries, can last as long as a century, and causes a colder earth. The most recent such event was the mini-Ice Age that climatologists date from around 1300 to 1850. In the midst of this there was a distinct solar hibernation from around 1650 to 1715. “Tapping reports no change in the sun’s magnetic field so far this cycle and if the sun remains quiet for another year or two, it may indicate a repeat of that period of drastic cooling of the Earth, bringing massive snowfall and severe weather to the Northern Hemisphere.**”** If you have been paying attention to global weather reports, you know that China has had the heaviest snowfall in at least three decades. David Deming, a geophysicist, in a December 19, 2007 article in The Washington Times, noted that, “South America this year experienced one of its coldest winters in decades. In Buenos Aires, snow fell for the first time since the year 1918.” This occurred across the entire Southern Hemisphere. “Johannesburg, South Africa, had the first significant snowfall in 26 years. Australia experienced the coldest June ever.” This represents a major threat to Earth’s population because it means that food crops will fail and, with them, the means to feed livestock, and the rest of us.

1. Ice Age would lead to extinction

**Kate 2011 (climate scientist from the Canadian Prairies who worked with** [**Dr. Steve Easterbrook**](http://www.cs.toronto.edu/~sme/) **at the University of Toronto, “Extinction and Climate” Climate Sight** http://climatesight.org/2011/02/17/extinction-and-climate/) **bc**¶

Life on Earth does not enjoy change, and climate change is something it likes least of all. Every aspect of an organism’s life depends on climate, so if that variable changes, everything else changes too – the availability of food and water, the timing of migration or hibernation, even the ability of bodily systems to keep running.¶ Species can adapt to gradual changes in their environment through evolution, but climate change often moves too quickly for them to do so. It’s not the absolute temperature, then, but the rate of change that matters. Woolly mammoths and saber-toothed tigers thrived during the Ice Ages, but if the world were to shift back to that climate overnight, we would be in trouble.**¶** Put simply, if climate change is large enough, quick enough, and on a global scale, it can be the perfect ingredient for a mass extinction. This is worrying, as we are currently at the crux of a potentially devastating period of global warming, one that we are causing. Will our actions cause a mass extinction a few centuries down the line? We can’t tell the future of evolution, but we can look at the past for reference points.

Ice age is worse than a nuclear war

Felix 2000 (Robert Felix, former architect and Research and Ice expert, “Not by Fire but by Ice” Free Republic) <http://www.freerepublic.com/focus/f-news/1909050/posts>) bc

It was mass extinction, global and sudden. Seventy-five percent of all species on the planet went extinct, never again to appear in the geologic record. The sheer number of other deaths, say scientists, make the dinosaurs’ disappearance look like an afterthought. When 75% of all living species disappear from the face of the earth, we’ve got a disaster on our hands, a disaster greater than any nuclear holocaust we’ve ever tried to imagine. If we simultaneously exploded every nuclear weapon in existence in every country on earth, say scientists, we would not begin to match the devastation. Not even close. There must be an answer, and we’d better find it quick, before it happens again. It is going to happen again, and soon!

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Little Ice Age Consequences (Disease, famine, war) strikes fear towards a future ICE AGE

Jennie Cohen, Ravenscroft History Teacher, 2012, “Little Ice Age, Big Consequences,”1-31-12, <http://www.history.com/news/little-ice-age-big-consequences>) ap

Great Famine, beginning in the spring of 1315, cold weather and torrential rains decimated crops and livestock across Europe. Class warfare and political strife destabilized formerly prosperous countries as millions of people starved, setting the stage for the crises of the Late Middle Ages. According to reports, some desperate Europeans resorted to cannibalism during the so-called Great Famine, which persisted until the early 1320s. Black Death, typically considered an outbreak of the bubonic plague, which is transmitted by rats and fleas, the Black Death wreaked havoc on Europe, North Africa and Central Asia in the mid-14th century. It killed an estimated 75 million people, including 30 to 60 percent of Europe’s population. Some experts have tied the outbreak to the food shortages of the Little Ice Age, which purportedly weakened human immune systems while allowing rats to flourish. Thirty Years’ War Among other military conflicts, the brutal Thirty Years’ War between Protestants and Catholics across central Europe has been linked to the Little Ice Age. Chilly conditions curbed agricultural production and inflated grain prices, fueling civil discontent and weakening the economies of European powers. These factors indirectly plunged much of the continent into war from 1618 to 1648, according to this model.

Even Small Scale Ice Age leads to Natural Disasters and deadly climate change

Brendan Wolfe, Editor of Encyclopedia Virginia and writer/author, 2014,”The Little Ice Age and Colonial Virginia,”5-16-13,http://encyclopediavirginia.org/Little\_Ice\_Age\_and\_Colonial\_Virginia\_The#start\_entry

Whatever the cause or causes of the Little Ice Age, scientists and historians agree on its effects: unusually wet springs that caused flooding, hot and dry summers that led to droughts, and particularly cold winters. On January 30, 1607, a massive flood, possibly caused by a tsunami, struck southwestern England, killing as many as 3,000 people. One contemporary account describes a scene in Somerset County in which an infant "was found swimming in a Cradle, some mile or two fro' ye place where it was knowen to be kept, and so was preserved, for the Cradle was not of wicker as our are here [in London], but of strong thicke bordes, closely jointed together, and that saved the infants life." Droughts were the greater problem in America. When Jesuit missionaries, led by the Virginia Indian Don Luís de Velasco (Paquiquineo), arrived on the James River in the autumn of 1570, they encountered dry conditions and hunger. "We find the land of Don Luis in quite another condition than expected," one of the missionaries wrote, "not because he was at fault in his description of it, but because Our Lord has chastised it with six years of famine and death, which has brought it about that there is much less population than usual." When Thomas Hariot, John White, and the other English colonists landed at Roanoke in 1585, they found a land in the midst of unprecedented drought. The years 1587, 1588, and 1589 were the driest in the previous 800. The "corn began to wither," Hariot wrote, and the Indians worried that the drought was somehow connected to the arrival of the English. Conditions were just as bad when the English sailed into the Chesapeake Bay in 1607. Tree-ring studies conducted by scientists from the University of Arkansas, who examined a bald cypress near Jamestown, discovered that the colonists arrived at the beginning of a seven-year drought (1606–1612), the driest period in 770 years. Cold weather, meanwhile, was a constant threat. The Thames River froze over above London Bridge during the winter of 1607–1608, leading to the first of the so-called Frost Fairs, or festivals held on the river. The cold also caused hunger, as a contemporary writer—in an imaginary dialogue between a country man and a city man—reported: "The poor ploughman's children sit crying and blowing their nails," the country man says, "as lamentably as the children and servants of your poor artificers. Hunger pinches their cheeks, as deep into the flesh as it doth into yours here. You cry out here, you are undone for coals: and we complain, we shall die for want of wood." That winter in Virginia was no less severe. John Smith wrote of a cold so miserable that "a dogge would scarce have indured it." The colonist Francis Perkins, writing to a friend in England on March 28, 1608, described a cold "so intense that one night the river at our fort froze almost all the way across, although at that point it is as wide again as the one at London. The ice in the river froze some fish which, when we took them out after the ice was melted, were very good."

Ice Age would cause widespread disease and death

Scott Mandia, Professor of Physical Sciences, Date Not Given (Date Accessed: 7-21-14), “The Little Ice Age in Europe,” Date Not Given,<http://www2.sunysuffolk.edu/mandias/lia/little_ice_age.html>) ap

The cooler climate during the LIA had a huge impact on the health of Europeans. As mentioned earlier, dearth and famine killed millions and poor nutrition decreased the stature of the Vikings in Greenland and Iceland. Cool, wet summers led to outbreaks of an illness called St. Anthony's Fire. Whole villages would suffer convulsions, hallucinations, gangrenous rotting of the extremities, and even death. Grain, if stored in cool, damp conditions, may develop a fungus known as ergot blight and also may ferment just enough to produce a drug similar to LSD. Malnutrition led to a weakened immunity to a variety of illnesses. In England, malnutrition aggravated an influenza epidemic of 1557-8 in which whole families died. In fact, during most of the 1550's deaths outnumbered births (Lamb, 1995.) The Black Death (Bubonic Plague) was hastened by malnutrition all over Europe. One might not expect a typically tropical disease such as malaria to be found during the LIA, but Reiter (2000) has shown that it was an important cause of illness and death in several parts of England. The English word for malaria was ague, a term that remained in common usage until the nineteenth century.

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#### We are on path for an ice age

#### Ridley 2012 (Matt Ridley, British journalist, businessman, and Conservative member of the House of Lords, “Are We Holding a New Ice Age at Bay?” The Wall Street Journal) <http://online.wsj.com/news/articles/SB10001424052970204257504577150812451167538?mg=reno64-wsj&url=http%3A%2F%2Fonline.wsj.com%2Farticle%2FSB10001424052970204257504577150812451167538.html>) ec

The entire 10,000-year history of civilization has happened in an unusually warm interlude in the Earth's recent history. Over the past million years, it has been as warm as this or warmer for less than 10% of the time, during 11 brief episodes known as interglacial periods. One theory holds that agriculture and dense settlement were impossible in the volatile, generally dry and carbon-dioxide-starved climates of the ice age, when crop plants would have grown more slowly and unpredictably even in warmer regions. This warm spell is already 11,600 years old**,** andit must surely, in the normal course of things, come to an end.In the early 1970s, after two decades of slight cooling, many scientists were convinced that the moment was at hand. They were "increasingly apprehensive, for the weather aberrations they are studying may be the harbinger of another ice age," said Time in 1974. The "almost unanimous" view of meteorologists was that the cooling trend would "reduce agricultural productivity for the rest of the century," and "the resulting famines could be catastrophic," said Newsweek in 1975. Since then, of course, warmth has returned, probably driven at least partly by man-made carbon-dioxide emissions. A new paper, from universities in Cambridge, London and Florida, drew headlines last week for arguing that these emissions may avert the return of the ice age. Less noticed was the fact that the authors, by analogy with a previous warm spell 780,000 years ago that's a "dead ringer" for our own, expect the next ice age to start "within about 1,500 years." Hardly the day after tomorrow. Still, it's striking that most interglacials begin with an abrupt warming**,** peak sharply, then begin a gradual descent into cooler conditions before plunging rather more rapidly toward the freezer. The last interglacial—which occurred 135,000 to 115,000 years ago (named the Eemian period after a Dutch river near which the fossils of warmth-loving shell creatures of that age were found)—saw temperatures slide erratically downward by about two degrees Celsius between 127,000 and 120,000 years ago, before a sharper fall began. Cyclical changes in the earth's orbit probably weakened sunlight in the northern hemisphere summer and thus caused this slow cooling. Since the northern hemisphere is mostly land, this change in the sun's strength meant gradually increased snow and ice cove**r**, which in turn reflected light back into space. This would have further cooled the air and, gradually, the ocean too. Carbon-dioxide levels did not begin to fall much until about 112,000 years ago, as the cooling sea absorbed more of the gas. Our current interglacial shows a similar pattern**.** Greenland ice cores and other proxy records show that temperatures peaked around 7,000 years ago, when the Arctic Ocean was several degrees warmer than today, trees grew farther north in Siberia and the Sahara was wet enough for hippos (Africa generally gets wetter in warm times). Data from the southern hemisphere reveal that this "Holocene Optimum" was global in extent. An erratic decline in temperature followed, with Minoan, Roman and Medieval warm periods peaking at successively lower temperatures, culminating in the exceptionally cool centuries of the "Little Ice Age" between 1550 and 1850, when glaciers advanced all over the world. In the Greenland ice cores, these centuries stand out as the longest and most consistent cold spell of the current interglacial. In other words, our own interglacial period has followed previous ones in having an abrupt beginning and a sharp peak, followed by slow cooling. The question is whether recent warming is a temporary blip before the expected drift into glacial conditions, or whether humankind's impact on the atmosphere has now reversed the cooling trend.

#### Ice age is a threat to human life

#### Marsh 2008 (Gerald, retired physicist from the Argonne National Laboratory and a former consultant to the Department of Defense on strategic nuclear technology and policy in the Reagan, Bush, and Clinton Administration) <http://www.winningreen.com/site/epage/59549_621.htm>) ec

CHICAGO — Contrary to the conventional wisdom of the day, the real danger facing humanity is not global warming, but more likely the coming of a new Ice Age.What we live in now is known as an interglacial, a relatively brief **period** between long ice ages. Unfortunately for us, most interglacial periods last only about ten thousand years, and that is how long it has been since the last Ice Age ended. How much longer do we have before the ice begins to spread across the Earth’s surface? Less than a hundred years or several hundred? We simply don’t know. Even if all the temperature increase over the last century is attributable to human activities, the rise has been relatively modest one of a little over one degree Fahrenheit — an increase well within natural variations over the last few thousand years. While an enduring temperature rise of the same size over the next century would cause humanity to make some changes, it would undoubtedly be within our ability to adapt. Entering a new ice age, however, would be catastrophic for the continuation of modern civilization. One has only to look at maps showing the extent of the great ice sheets during the last Ice Age to understand what a return to ice age conditions would mean. Much of Europe and North-America were covered by thick ice, thousands of feet thick in many areas and the world as a whole was much colder. The last “little” Ice Age started as early as the 14th century when the Baltic Sea froze over followed by unseasonable cold, storms, and a rise in the level of the Caspian Sea. That was followed by the extinction of the Norse settlements in Greenlandand the loss of grain cultivation in Iceland. Harvests were even severely reduced in Scandinavia And this was a mere foreshadowing of the miseries to come. By the mid-17th century, glaciers in the Swiss Alps advanced, wiping out farms and entire villages. In England, the River Thames froze during the winter, and in 1780, New York Harbor froze. Had this continued, history would have been very different. Luckily, the decrease in solar activity that caused the Little Ice Age ended and the result was the continued flowering of modern civilization. There were very few Ice Ages until about 2.75 million years ago when Earth’s climate entered an unusual period of instability. Starting about a million years ago cycles of ice ages lasting about 100,000 years, separated by relatively short interglacial perioods, like the one we are now living in became the rule. Before the onset of the Ice Ages, and for most of the Earth’s history, it was far warmer than it is today. Indeed, the Sun has been getting brighter over the whole history of the Earth and large land plants have flourished. Both of these **h**ad the effect of dropping carbon dioxide concentrations in the atmosphere to the lowest level in Earth’s long history. Five hundred million years ago, carbon dioxide concentrations were over 13 times current levels; and not until about 20 million years ago did carbon dioxide levels drop to a little less than twice what they are today. It is possible that moderately increased carbon dioxide concentrations could extend the current interglacial period. But we have not reached the level required yet, nor do we know the optimum level to reach. So, rather than call for arbitrary limits on carbon dioxide emissions, perhaps the best thing the UN’s Intergovernmental Panel on Climate Change and the climatology community in general to do is spend their efforts on determining the optimal range of carbon dioxide needed to extend the current interglacial period indefinitely. NASA has predicted that the solar cycle peaking in 2022 could be one of the weakest in centuries and should cause a very significant cooling of Earth’s climate. Will this be the trigger that initiates a new Ice Age? We ought to carefully consider this possibility before we wipe out our current prosperity by spending trillions of dollars to combat a perceived global warming threat that may well prove to be only a will-o-the-wisp.

# **Global Warming prevents Ice Age**

#### **Greenhouse Gas Emmissions prevent ice age**

Vieru, 14 (Tudor. "Global Warming Prevents New Ice Age from Ocurring" KBJ

It's common knowledge among climate scientists that ice ages occur regularly on Earth. Multi-millennial winters set in about once every 11,000 years or so, and the latest one failed to start. Scientists believe that global warming and climate change are responsible for the current state of affairs.¶ The last ice age that occurred on schedule took place about 11,600 years ago, so we're already more than half of a millennium late for the next one. According to experts, it could be that this natural cycle will stop now, primarily because of the vast amounts of pollutants we are releasing into the atmosphere.¶ Carbon dioxide, methane and other greenhouse gases are warming up the planet, putting a dent in various natural cycles. Apparently, the phenomenon is also influencing processes we had no idea were susceptible to such changes.¶ At this point, figuring out what the latest discovery means is still far away, since the issue is complex. Scientists need to analyze the implications of their findings in a holistic manner, meaning that they need to look at multiple systems – and how they relate – at the same time. ¶ A team of experts from the University of Cambridge, in the United Kingdom, published a research paper in this week's issue of the top journal Nature Geoscience, highlighting how the next ice age would have occurred if CO2 concentrations were normal, and if we weren't around to influence it.¶ Through complex simulations, the researchers were able to determine that the ice age would start in the next 1,000 years, no later. While this may seem like a lot to us, it's in fact a very brief period of geologic time, from our planet's perspective. ¶ The new study was also able to discover what experts call glacial inception, or the signature of how an ice age gets activated. The main way they went about doing so was to analyze temperature contrasts developing between Greenland and Antarctica.¶ “The mystery of the ice ages, which represent the dominant mode of climate change over the past few million years, is that while we can identify the various ingredients that have contributed to them, it’s the arrangement of these ingredients, and how they march to the beat of subtle changes in seasonality, that we lack an understanding of,” Dr Luke Skinner explains. ¶ The expert, who holds an appointment as a professor at the Cambridge Department of Earth Sciences, led the work with professor David Hodell, also from Cambridge, and University College London (UCL) colleague, professor Chronis Tzedakis.

#### Global Warming is helping to stop the next Ice Age

Cocks, 12/21/2009, Professor at Duke University, “Will the greenhouse effect prevent the return of glaciers,” <http://www.technologyreview.com/article/416786/global-warming-vs-the-next-ice-age/> AP

Global warming is an inescapable issue for our age. But 180 years ago, most scientists believed that Earth had been steadily cooling since it was formed. When Louis Agassiz presented the concept of a Great Ice Age to the Swiss Society of Natural Sciences in 1837, his suggestion that the planet had turned colder and then warmed up again was met with skepticism and even hostility, triggering years of fierce scientific debate before the idea was accepted.

Exactly why our planet occasionally cools down has taken more than a century to work out. Now we know that cyclic gravitational tugs from Jupiter and Saturn periodically elongate Earth’s orbit, and this effect combines from time to time with slow changes in the direction and degree of Earth’s tilt that are caused by the gravity of our large moon. Consequently, summer sunlight around the poles is reduced, and high-latitude regions such as Alaska, northern Canada, and Siberia turn cold enough to preserve snow year-round. This constant snow cover reflects a great deal of sunlight, cooling things down even more, and a new ice age begins. Naturally, this process does not occur with anything like the speed portrayed in the movie The Day After Tomorrow, but geological and other evidence shows that it’s happened at least four times.

With so much attention focused on global warming, this chilly prospect has been all but forgotten. Given how catastrophic another ice age could be, one might be tempted to ask whether a human-caused increase in atmospheric and ocean temperatures will actually be a boon.

#### Increased greenhouse gases stalls new ice age cycle

Stephan Vavrus, John Kutzbach, University of Wisconsin-Madison, 08 ("Did Early Global Warming Divert A New Ice Age?" http://www.sciencedaily.com/releases/2008/12/081217190433.htm)KBJ

What's more, according to the same computer simulations,thecumulative effect of thousands of years of human influence on climate is preventing the world from entering a new glacial age, altering a clockwork rhythm of periodic cooling of the planet that extends back more than a million years.

"This challenges the paradigm that things began changing with the Industrial Revolution," says Stephen Vavrus, a climatologist at the University of Wisconsin-Madison's Center for Climatic Research and the Nelson Institute for Environmental Studies. "If you think about even a small rate of increase over a long period of time, it becomes important."

Addressing scientists on Dec 17 at a meeting of the American Geophysical Union, Vavrus and colleagues John Kutzbach and Gwenaëlle Philippon provided detailed evidence in support of a controversial idea first put forward by climatologist William F. Ruddiman of the University of Virginia. That idea, debated for the past several years by climate scientists, holds that the introduction of large-scale rice **agriculture** in Asia, coupled with extensive deforestationin Europe began to alter world climate by pumping significant amounts of greenhouse gases — methane from terraced rice paddies and carbon dioxide from burning forests — into the atmosphere**.** In turn, a warmer atmosphere heated the oceans making them much less efficient storehouses of carbon dioxide and reinforcing global warming.

That one-two punch, say Kutzbach and Vavrus,was enough to set human-induced climate change in motion**.**

"No one disputes the large rate of increase in greenhouse gases with the Industrial Revolution," Kutzbach notes. "The large-scale burning of coal for industry has swamped everything else" in the record.

But looking farther back in time, using climatic archives such as 850,000-year-old ice core records from Antarctica, scientists are teasing out evidence of past greenhouse gases in the form of fossil air trapped in the ice. That ancient air, say Vavrus and Kutzbach, contains the unmistakable signature of increased levels of atmospheric methane and carbon dioxide beginning thousands of years before the industrial age.

"Between 5,000 and 8,000 years ago, bothmethane and carbon dioxide started an upward trend, unlike during previous interglacial periods," explains Kutzbach. Indeed, Ruddiman has shown thatduring the latter stages of six previous interglacials, greenhouse gases trended downward, not upward. Thus, the accumulation of greenhouse gases over the past few thousands of years, the Wisconsin-Virginia team argue, is very likelyforestalling the onset of a new glacial cycle**,** such as have occurred at regular 100,000-year intervals during the last million years. Each glacial period has been paced by regular and predictable changes in the orbit of the Earth known as Milankovitch cycles, a mechanism thought to kick start glacial cycles.

"We're at a very favorable state right now for increased glaciation," says Kutzbach. "Nature is favoring it at this time in orbital cycles, and if humans weren't in the picture it would probably be happening today."

Importantly, the new research underscores the key role of greenhouse gases in influencing Earth's climate**.** Whereas decreasing greenhouse gases in the past helped initiate glaciations, the early agricultural and recent industrial increases in greenhouse gases may be forestalling them**,** say Kutzbach and Vavrus.

Using three different climate models and removing the amount of greenhouse gases humans have injected into the atmosphere during the past 5,000 to 8,000 years, Vavrus and Kutzbach observed more permanent snow and ice cover in regions of Canada, Siberia, Greenland and the Rocky Mountains, all known to be seed regions for glaciers from previous ice ages. Vavrus notes: "With every feedback we've included, it seems to support the hypothesis (of a forestalled ice age) even more. We keep getting the same answer."

#### Reversing warming will start the next Ice Age

**Wilson and Watson, 4/21/2006**, Writers for HowStuffWorks, “Could reversing global warming start an ice age,” <http://science.howstuffworks.com/environmental/green-science/question7801.htm> **AP**

According to one school of thought, a warming planet is one that's less likely to wind up in an [ice age](http://geography.howstuffworks.com/terms-and-associations/ice-age.htm). Because the [Earth](http://science.howstuffworks.com/environmental/earth/geophysics/earth.htm) is always going through warming and cooling cycles, and we've been in one of the warming cycles for about 12,000 years now, scientists say it's inevitable that we'll hit another big chill sometime in the next 10,000 to 100,000 years. If that happens, much of the world -- including Europe and North America -- would be covered in a thick sheet of ice. According to some researchers, the heat trapped in the Earth's atmosphere from the greenhouse effect will offset this cooling -- essentially preventing the Earth from entering another ice age [sources: [Science Daily](http://www.sciencedaily.com/releases/2008/12/081217190433.htm), [Cosmos](http://www.cosmosmagazine.com/node/2305/full)].

#### Global Warming prevents the next Ice Age

France-Presse, 08

(Agence. "Global Warming to stave off Ice Age" <http://cosmosmagazine.com/news/global-warming-may-stave-ice-age/>) KBJ

**Earth has experienced long periods of extreme cold over the billions of years of its history. The big freezes are interspersed with “interglacial” periods of relative warmth, of the kind we have experienced since the end of the last Ice Age, around 11,000 years ago. ¶**These climate swings have natural causes, believed to be rooted particularly in changes in Earth’s orbit and axis that, while minute, have a powerful effect on how much solar heat falls on the planet. The two researchers behind the study built a high-powered computer model to take a closer look at these intriguing phases of cooling and warmth. In addition to the planetary shifts, they also factored in levels of carbon dioxide (CO2), found in tiny bubbles in ice cores, that provide an indicator of temperature spanning hundreds of thousands of years. The model revealed dramatic swings in climate, including changes when Earth flipped from one state to the other over a relatively short time, said one of the authors, geoscientist Thomas Crowley of the University of Edinburgh in Scotland. These shifts, called “bifurcations,” appear to happen in abrupt series, which is counter-intuitive to the idea that the planet cools or warms gradually. “You had a big change about a million years ago; then a second change around 650,000 years ago, when you had bigger glaciations; then 450,000 years ago, when you started to get more repeated glaciations,” said Crowley. “What’s also interesting is that the inter-glaciations also became warmer.” According to the model, authored by Crowley and physicist William Hyde of Toronto University in Canada, the next “bifurcation” would normally be due between 10,000 and 100,000 years from now. The chill would likely induce a long, stable period of glaciation in the mid-latitudes, smothering Europe, Asia and North America to about 45 to 50º latitude with a thick sheet of ice. However, there is now so much CO2 in the air, as a result of fossil-fuel burning and deforestation, that this adds a heat-trapping greenhouse effect that will offset the cooling impacts of orbital shift, said Crowley.“Even the level that we have there now is more than sufficient to reach that critical state seen in the model,” he said. “If we cut back [on CO2] some, that would probably still be enough.” In September, a scientific research consortium called the Global Carbon Project (GCP) said that atmospheric concentrations of CO2 reached 383 parts per million (ppm) in 2007, or 37 per cent above pre-industrial levels. Present concentrations are “the highest during the last 650,000 years and probably during the last 20 million years,” the report said.

#### Ice Age prevented by climate change

09 Jan 2012, 18:28 Verity Payne, <http://www.carbonbrief.org/blog/2012/01/lethal-ice-age-prevented-by-climate-change/>

The Nature Geoscience paper: Man-made emissions may delay ice age It's thought that ice ages are triggered by small changes in the Earth's orbit around the sun. The pattern of these changes indicate that another ice age might begin in around 1,500 years. However, scientists have now found that man-made greenhouse gas emissions are warming the Earth enough to prevent it from responding in the way that it has over the last million years. Professor Jim Channell, University of Florida, one of the report's co-authors, explains: "We know from past records that Earth's orbital characteristics during our present interglacial period are a dead ringer for orbital characteristics in an interglacial period 780,000 years ago." Scientists would expect the Earth to behave in a similar way to that period, but human greenhouse gas emissions may have disrupted the normal glaciation cycle. As Channell puts it: "The problem is that now we have added to the total amount of CO2 cycling through the system by burning fossil fuels, the cooling forces can't keep up."

#### Global Warming prevents ice age

Discovery Channel, Date not specified

http://curiosity.discovery.com/question/global-warming-prevent-ice-age

The Earth experiences cycles of warming and cooling. The cooling cycles often lead to extremely cold temperatures that cause ice ages. Some scientists believe that global warming could disrupt these cycles. Gases such as carbon dioxide -- so-called greenhouse gases -- being trapped in the planet's atmosphere cause global warming. These gases trap heat in the atmosphere as well, a phenomenon called the greenhouse effect. The greenhouse effect potentially could prevent the Earth from entering the cooling period necessary for another ice age.

#### Next Ice Age Delayed by Global Warming, Study Says

Christine Dell'Amore, National Geographic News, September 3, 2009, <http://news.nationalgeographic.com/news/2009/09/090903-arctic-warming-ice-age.html> KBJ

Humans are putting the brakes on the next ice age, according to the most extensive study to date on Arctic climate change. Ice Age, Interrupted Earth's angle toward the sun changes due to a natural 26,000-year-long wobble, which causes the planet to spin on is axis like an unstable top, so that a line drawn from the axis would trace a cone in the sky. The wobble causes Earth to make its closest pass by the sun in different months over the long term. For the past 7,000 years, Earth has passed closest to the sun in January. This means less sunlight has been hitting the Arctic during its summertime, so the region should be cooling. (See an Arctic map.) To estimate past temperatures, the research team looked at Arctic lake sediments and at previously published data of glacial ice cores and tree rings. The team also examined a computer model of global climate based at the National Center for Atmospheric Research in Colorado. Miller and colleagues found that the wobble in Earth's tilt causes Arctic temperatures to drop by about 0.36 degree Fahrenheit (0.2 degree Celsius) every thousand years during a cooling phase. But human-caused global warming overwhelmed that gradual cooling in the mid-1990s, shooting temperatures up by about 2.5 degrees Fahrenheit (1.4 degrees Celsius) over the course of a few decades. In fact four of the five warmest decades in the past 2,000 years occurred after 1950, according to the study, which will be published tomorrow in the journal Science. Ecologist Syndonia Bret-Harte said she has seen the effects of climate change firsthand during her research on the changing Alaskantundra. The new study "doesn't seem that surprising, but it's good to confirm what researchers were already thinking," said Bret-Harte, of the Institute of Arctic Biology at the University of Alaska, Fairbanks.

#### Global Warming Could Forestall Ice Age

ANDREW C. REVKIN, September 3, 2009, (<http://www.nytimes.com/2009/09/04/science/earth/04arctic.html?_r=0>) KBJ

Scientists familiar with the work, to be published Friday in the journal Science, said it provided fresh evidence that human activity is not only warming the globe, particularly the Arctic, but could also even fend off what had been presumed to be an inevitable descent into a new ice age over the next few dozen millenniums. The reversal of the slow cooling trend in the Arctic, recorded in samples of layered lakebed mud, glacial ice and tree rings from Alaska to Siberia, has been swift and pronounced, the team writes.

#### Next Ice Age Delayed By Global Warming Gases

Chestney, 1/9/2012**,** Senior Energy and Environment Correspondent, “Next Ice Age Delayed By Global Warming Gases, Study Finds,” <http://www.huffingtonpost.com/2012/01/09/next-ice-age-global-warming_n_1193900.html> **AP**

High levels of carbon dioxide emissions in the atmosphere means the next ice age is unlikely to begin for at least 1,500 years, an article in the journal Nature Geoscience said on Monday. Concentrations of the main gases blamed for global warming reached record levels in 2010 and will linger in the atmosphere for decades even if the world stopped pumping out emissions today, according to the U.N.'s weather agency. An ice age is a period when there is a long-term reduction in the earth's surface and atmospheric temperature, which leads to the growth of ice sheets and glaciers. There have been at least five ice ages on earth. During ice ages there are cycles of glaciation with ice sheets both advancing and retreating. Officially, the earth has been in an interglacial or warmer period, for the last 10,000 to 15,000 years, and estimates vary on how long such periods last. "(Analysis) suggests that the end of the current interglacial (period) would occur within the next 1,500 years, if atmospheric CO2 concentrations do not exceed (around) 240 parts per million by volume (ppmv)," the study said. However, the current carbon dioxide concentration is of 390 ppmv, and at that level an increase in the volume of ice sheets would not be possible, it added. The study based on variations in the earth's orbit and rock samples was conducted by academics at Cambridge University, University College London, the University of Florida and Norway's University of Bergen. The causes of ice ages are not fully understood but concentrations of methane and carbon dioxide in the atmosphere, changes in the earth's orbit around the sun, and the movements of tectonic plates are all thought to contribute. The world is forecast to grow hotter as greenhouse gases continue to rise, increasing threats such as extreme weather events and sea level rise. Scientists have warned that global temperature rise should be limited to within 2 degrees Celsius to avoid the worst effects of climate change but delays in curbing emissions growth are putting the planet at risk.

## **Aff Answers**

### AT- Warming not happening

#### Warming is real

**Wagner 14** (Joan Wagner, Saratoga Springs, 7-6-14, “Climate Change is a fact, Not a Theory”, The Daily Gazette, <http://www.dailygazette.com/news/2014/jul/06/0706_online/>) EX

I was not going to respond the June 17 letter “Academia’s arrogance reflected in climate change debate,” but as a science educator and author, I feel it is my duty to respond. First, *over 97 percent of scientists agree that climate change is happening “unequivocally*,” as noted in the Intergovernmental Panel on Climate Change (IPCC) Report. All scientific research papers undergo peer review. *When only 3 percent of the scientific community question the accuracy of the research, it is far from a debate (source of statistic is from NASA*).When the new National Standards for science education called the Next Generation of Science Standards (NGSS),” mentions climate change over 16 times because the evidence supporting it is as strong as that supporting the theory of evolution or Einstein’s theory of relativity, including it as an integral part of the standards was essential to science literacy. *Carbon dioxide* is a greenhouse gas that *has increased by over 42 percent since the Industrial Revolution* (from 280 parts per million (ppm) to over 400 ppm). *However, this does not mean there will be an immediate corresponding increase in temperature of our atmosphere*. *Climate on Earth is too complex for that. There are many variables that impact climate, such as topography, large bodies of water, El Nino (warming) and La Nina (cooling) in the Pacific Ocean, volcanic eruptions and the oscillation of Earth as it rotates on its axis.The increased heat captured by greenhouses gases is causing our oceans to warm.* Remember, *our planet is 70 percent water*. Water has what scientists call, a "high specific heat." It absorbs and releases heat slowly. *It acts as a huge sink to deposit heat energy*. Thus, *its capacity to store and release heat is immense*. Heat transfer depends on differences in temperature. As the temperature differences between the oceans and atmosphere increase, so will the amount of heat energy they transfer. Hence*, the 42 percent increase in carbon dioxide is very significant; it will just take a while to fully experience its impact*.The main difference between natural climate changes and anthropogenic changes is the speed by which it is taking place. Climatologists are most concerned about the greenhouse gas, carbon dioxide, because it stays in the atmosphere much longer than the other greenhouse gases, giving it the greatest radiative forcing potential. Radiative forcing is the ability of a greenhouse gas to radiate heat back to Earth.*According to NASA, “As the Earth moved out of ice ages over the past million years, the global temperature rose a total of 4 to 7 degrees Celsius over about 5,000 years. In the past century alone, the temperature has climbed 0.7 degrees Celsius, roughly 10 times faster than the average rate of ice-age-recovery warming*.” Hence, when we talk about climate change induced by human activity, it is *the speed in which it is taking place that separates it from our planet’s history of glacial and interglacial periods*.The author of the letter I am responding to suggests the increase in our global temperature is because we were coming out of a mini ice age. Climatologists know that. Their concern is that *the temperature of our planet never changed that fast naturally*.I would like to close with a statement from the late Stephen Schneider, one of the coordinating authors of the IPCC Report. I coordinate speakers for the Science Teachers Association of New York State (STANYS), and he was the keynote speaker in 2007. It was fun for me because he would share some of his emails with me from those working on the IPPC Report. He explained to the audience *that climate change is based on consensus science.* When thousands of research papers were reviewed by over 2,000 scientists from around the world, they concluded that *climate change was “unequivocally” happening*.

### AT- Ice Age coming

### AFF Link Answers

**By disturbing a massive ocean current, melting Arctic sea ice might trigger colder weather in Europe and North America.**

**Science News, 3/5/2004**, NASA ran website, “A Chilling Possibility,” <http://science.nasa.gov/science-news/science-at-nasa/2004/05mar_arctic/> **AP**

**Global warming could plunge North America and Western Europe into a deep freeze, possibly within only a few decades. That's the paradoxical scenario gaining credibility among many climate scientists. The thawing of sea ice covering the Arctic could disturb or even halt large currents in the Atlantic Ocean. Without the vast heat that these ocean currents deliver--comparable to the power generation of a million nuclear power plants--Europe's average temperature would likely drop 5 to 10°C (9 to 18°F), and parts of eastern North America would be chilled somewhat less. Such a dip in temperature would be similar to global average temperatures toward the end of the last ice age roughly 20,000 years ago. Some scientists believe this shift in ocean currents could come surprisingly soon--within as little as 20 years, according to Robert Gagosian, president and director of the Woods Hole Oceanographic Institution.**

#### Global Warming Causes Ice Age

Discovery Channel, Date not specified

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Ocean currents are partially responsible for distributing heat around the Earth**. The Gulf Stream, for example, is a current that directs warm water to northern Europe from the Gulf of Mexico. By doing so, the Gulf Stream makes temperatures in Great Britain and the rest of northwestern Europe warmer than they otherwise would be.** As global temperatures rise, Arctic ice melts and massive amounts of fresh water pour into the North Atlantic and slow the Gulf Stream down**.** By **slowing or** stopping this ocean current, global warming actually would cool Europe down dramatically. If other ocean currents were disrupted, the entire planet could experience the same cooling effect and cause an ice age.

#### Global Warming can cause an Ice Age

**Battersby, 5/16/2007**, Writer for NewScientist, “Climate myths: Warming will cause an ice age in Europe,” [http://www.newscientist.com/article/dn11838-climate-myths-warming-will-cause-an-ice-age-in-europe.html#.U86XUPldVqV](#.U86XUPldVqV) **AP**

While the rest of Earth swelters, might Europe and parts of North America freeze? This scenario was always unlikely, and the latest findings largely rule it out. Europe and parts of North America are kept milder than other northerly parts by warm water flowing north from the Caribbean in an ocean current called the North Atlantic Drift. If climate change broke this heating system, European temperatures could drop by up to 5°C or more within decades. Some have even talked of a new ice age, of tundra spreading across the continent, while the film The Day After Tomorrow depicted the Earth plunging into a super ice age within weeks (see [Scientists stirred to ridicule ice age claims](http://www.newscientist.com/article/dn4888-scientists-stirred-to-ridicule-ice-age-claims.html)). Well, global warming certainly could disturb ocean currents. They are largely driven by the sinking of cold, salty water in the Arctic, but melting glaciers and swollen rivers are now pouring more fresh water into the surface of the Arctic ocean than before. Fresh water is less dense than salty, so it weakens this "pump". Enough could hinder ocean circulation, or [even cut it off](http://www.newscientist.com/article/mg19025471.300-climate-change-the-great-atlantic-shutdown.html), as may have [happened in the past](http://www.earthinstitute.columbia.edu/news/2006/story01-10-06.html). In 2005, climatologists were shocked by evidence that it was already happening. A team of oceanographers led by Harry Bryden of Southampton University, UK, claimed there was a 30% reduction in the vital Atlantic current. But subsequent measurements by the team show [no clear trend](http://www.newscientist.com/article/mg19225763.900-no-new-ice-age-for-western-europe.html). Few scientists think there will be a rapid shutdown of circulation. Most ocean models predict no more than a slowdown, probably towards the end of the century. This could slow or even reverse some of the warming due to human emissions of greenhouse gases, which might even be welcome in an overheated Europe, but the continent is not likely to get colder than it is at present. A slowdown in circulation would affect many parts of the world by disrupting global rainfall patterns. But these effects will be insignificant compared with the much greater changes global warming will cause (see also [It's too cold where I live. A bit of warming will be great](http://www.newscientist.com/article/dn11657-climate-myths-its-too-cold-where-i-live--warming-will-be-great.html)).

### AFF Impact Answers

#### Ice Age unlikely due to regular warming and cooling

**Stauffer 14** (Clyde Stauffer, Finneytown, 7-9-14, “Earth Warms and Cools Periodically- No Big Deal”, Cincinnati, <http://www.cincinnati.com/story/opinion/readers/2014/07/09/earth-warms-and-cools-periodically---no-big-deal/12402603/>) EX

In the letters to the editor "Williams rejects science outside his expertise" (July 8), the writer takes Dr. Walter Williams to task for deriding "global warming," in the face of climatological evidence. But this points out an imprecision in this current debate.First, *the globe has for millennia (or even aeons) undergone alternate warming and cooling episodes.* One thousand years ago the Vikings were raising barley on fields in Greenland that are now snow covered most of the year. *In the '70s climatologists were warning of the advent of a new ice age. In short, nothing new is happening.* Second, "*global warming" is used by many as shorthand for "humans are causing it by releasing CO2* by burning coal, oil and wood". *The rise in atmospheric CO2 concentration started early in the 20th century* (and continued through the "new ice age"). *"Green" proponents are using climate change as a bludgeon to attack their enemies: automobiles, coal- and oil-fired electric plants*.Third, *President Obama has told us that by changing our lifestyle and its supporting technology, we can reverse the onset of global warming.* I make reference to King Canute.*In sum: the earth, for reasons unknown, warms and cools periodically; the current trend makes a handy weapon for* the furtherance of *certain political agendas*; *and the human race, this speck on the surface of the globe, can reverse an inconvenient episode.*

#### **Ice Age won’t happen- conditions different**

Cooper-White 14 (Macrina Cooper-White, Huffington Post reporter, 1-24-14, Huffington Post, “Sun Scientists Debate Whether Solar Lull Could Trigger Another 'Little Ice Age,’” <http://www.huffingtonpost.com/2014/01/24/solar-lull-little-ice-age-sun-scientists_n_4645248.html> NC

If you thought the polar vortex was bad, get a load of a new climate phenomenon that just might be coming our way.¶ Some scientists say we could be headed for another "Little Ice Age," given how eerily calm the sun has been in recent years.¶ First, a bit of background. The sun goes through cycles that last roughly 11 years, marked by the ebb and flow of sunspots on its surface. At peak sunspot activity, the so-called solar maximum, the sun sports lots of sunspots and is steadily unleashing solar flares and coronal mass ejections (CMEs). Since our current solar cycle, Number 24, kicked off in 2008, the number of sunspots observed has been half of what heliophysicists expected.¶ “I’ve never seen anything quite like this," Dr. Richard Harrison, head of space physics at Rutherford Appleton Laboratory in England, told the BBC. "If you want to go back to see when the sun was this inactive in terms of the minimum we’ve just had and the peak that we have now, you’ve got to go back about 100 years.”¶ Now, being in a "solar lull" does not mean the sun is completely dormant.¶ "The sun is most definitely not 'asleep,'" Dr. C. Alex Young, solar astrophysicist and associate science director in the Heliophysics Science Division of NASA's Goddard Space Flight Center, told The Huffington Post in an email. In fact, on January 7th, 2014, NASA observed a massive solar flare burst from a sunspot group measured to be "some seven Earth's across."¶ But a relatively quiet sun could cause problems. Some scientists say that this period of weak solar activity may mirror what happened before the so-called Maunder Minimum of 1645 to 1715 -- a period named after solar astronomers Annie and E. Walter Maunder, who studied sunspots and helped identify the sun's strange activity in the latter part of the 17th Century. That time period saw only 30 sunspots (one one-thousandth of what would be expected) and coincided with a "Little Ice Age" in Europe, during which the Thames River and the Baltic Sea froze over.¶ Mike Lockwood, professor of space environment physics at the University of Reading in the U.K., estimated that we have up to a one-in-five chance of being in Maunder Minimum conditions 40 years from now.¶ While scientists have not proven that low sunspot activity directly caused the "Little Ice Age," and say other factors may have been involved in plunging Europe into the frigid period, they do believe that fewer sunspots may mean less solar energy reached Earth. And this in turn could have led to global cooling.¶ So if the sun did enter another extended period of low activity, how likely is it we'd enter into our own "Little Ice Age?"¶ "A new Maunder Minimum will not necessarily affect the Earth in the same way it did during the 17th Century," Giuliana de Toma of the National Center for Atmospheric Research's High Altitude Observatory told HuffPost in an email. "Volcanic eruptions (that have a short-term cooling effect) also played a role in the cold weather observed during the 17th century. Plus we are starting from a warmer Earth." ¶ So maybe not something as dramatic as an Ice Age would happen. But wait a second. If we're trying to combat global warming, could a little cooling action from the sun actually help turn down the heat on Earth?¶ Maybe, but it wouldn't do much, and not for very long. Researchers at the National Center for Atmospheric Research used a computer model to predict the effect of a future "grand solar minimum" on Earth's climate from 2020 to 2070. The model suggested the minimum might temporarily slow down the warming process by 20-30 percent. But within a few decades afterward, the temperatures would go right back to where they would have been anyway. Sigh.

#### **Ice Age doesn’t solve warming- temperatures stay high**

Cooper-White 14 (Macrina Cooper-White, Huffington Post reporter, 1-24-14, Huffington Post, “Sun Scientists Debate Whether Solar Lull Could Trigger Another 'Little Ice Age,’” <http://www.huffingtonpost.com/2014/01/24/solar-lull-little-ice-age-sun-scientists_n_4645248.html> NC

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# Aff: A2 Global Warming prevents Ice Age

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# A2: Ice Age Bad

#### Adaptation to Ice Age possible Nature adapts to survive climate change-

#### Jonathan Silver 2013 <http://blogs.reuters.com/great-debate/2013/03/15/nature-adapts-to-survive-climate-change/>

Animals, plants and even insects are now adapting quickly to shifts in temperatures, often by migrating to cooler climates, modifying their diets and altering breeding cycles.

This is happening at blinding speed in large, complex ecosystems. Throughout most of the 20th century, for example, tree range shift occurred at about 0.4 miles a year. Since 1990, however, climate changes have caused species range to move by an average of 12 miles a year. A 2009 U.S. Forest Service study, tracking 40 major tree species in 30 Eastern states, concluded that tree ranges had moved, on average, more than 60 miles north in less than a century.

More than 60 percent of the birds the National Wildlife Federation tracked in a recent study have expanded their range northward by an average of 35 miles in the last 40 years. Fourteen small mammal species in the Sierra Nevada Mountains were found to have extended the elevation at which they can survive by an average of 1,640 feet.

This rapid adaptation is occurring around the world. British researchers recently analyzed more than 2,000 animal and plant species in Britain and found that many had already made significant adaptations to a changing environment.

#### Geothermal activity helps life survive Ice Age

**Fraser, 3/10/14,** Lecturer at Fenner School of Environment and Society, Australian National University, “Volcanoes May Have Helped Life Survive Ice Ages,” [http://www.sci-](http://www.sci-news.com/othersciences/geophysics/science-volcanoes-life-ice-ages-01800.html)[news.com/othersciences/geophysics/science-volcanoes-life-ice-ages-01800.html](http://www.sci-news.com/othersciences/geophysics/science-volcanoes-life-ice-ages-01800.html) **AP**

Researchers studied tens of thousands of records of Antarctic species and found there are more species close to volcanoes, and fewer further away. “The closer you get to volcanoes, the more species you find. This pattern supports our hypothesis that species have been expanding their ranges and gradually moving out from volcanic areas since the last Ice Age,” explained study co-author Dr Aleks Terauds from the Australian Antarctic Division. Antarctica has about 16 volcanoes which have been active since the last Ice Age 20,000 years ago. The scientists examined diversity patterns of mosses, lichens and bugs which are still common in Antarctica today. “Around 60 per cent of Antarctic invertebrate species are found nowhere else in the world,” said co-author Prof Peter Convey from the British Antarctic Survey. “They have clearly not arrived on the continent recently, but must have been there for millions of years. How they survived past Ice Ages – the most recent of which ended less than 20,000 years ago – has long puzzled scientists.” “Volcanic steam can melt large ice caves under the glaciers, and it can be tens of degrees warmer in there than outside. Caves and warm steam fields would have been great places for species to hang out during Ice Ages,” said lead author Dr Ceridwen Fraser from the Australian National University. “We can learn a lot from looking at the impacts of past climate change as we try to deal with the accelerated change that humans are now causing.” While the study was based on Antarctica, the findings help scientists understand how species survived past Ice Ages in other icy regions, including in periods when it is thought there was little or no ice-free land on the planet. Also the results could help guide conservation efforts in Antarctica. “Knowing where the ‘hotspots’ of diversity are will help us to protect them as human-induced environmental changes continue to affect Antarctica,” said senior author Prof Steven Chown from Monash University.

#### Humans can survive the next Ice Age

Joyce and Keigwin, 7/6/2009, Senior Scientists at Woods Hole Oceanographic Institution, “Can Humans Survive another Ice Age,” <http://leecustodio.hubpages.com/hub/Can-Humans-Survive-another-Ice-Age>, **AP**

[Abrupt changes in temperature](http://hubpages.com/hub/The-Tipping-Point--Our-Climates-Point-of-No-Return) happen within decades or millennia giving much time for humans to adopt with the gradual change in the environment. After all studies have shown that for the past millions of years, the Earth has indicated a repeated cycle of earth’s climate going from warm phase to glacial environment. James Croll’s theory in the 19th century and later on developed fully by Milutin Milankovitch in 1938 states that the orbital shifts cause the waxing and waning of ice ages. These periods of shifts are associated with the changes in the tilt of Earth’s rotational axis; changes in the orientation of Earth’s elliptical orbit around the sun called “precession of the equinoxes”; and the changes in the shape, more rounded or less rounded, of the elliptical orbit. Indeterminate Ice age conditions in general happens when all of the mentioned conditions work together to create a minimum of summer sunlight on the arctic regions of the earth, although the Ice Age cycle is global in nature and occurs in phase in both north and south hemispheres, it extremely affects distribution of ice over bodies of land and ocean, atmospheric temperatures and circulation, and ocean temperatures and circulation in the surface and in great depth (Joyce & Keigwin, 2009). But the main question remains, can humans survive another ice age? Joyce and Keigwin (2009) reiterated that climate change from warm periods to glacier conditions are happening rapidly and are now becoming decade-long transitions rather than the cycles that had happened before that are millennial in shifts. This phenomenon is exacerbated because of immense human production of carbon dioxide that gets trap in the air causing greenhouse effect. And In order to balance the excess heating near the equator and cooling at the poles of the earth, both north and south atmosphere and ocean carry heat from low to high latitudes. Warmer surface water is cooled at high latitudes, releasing heat to the atmosphere, which is then radiated towards space. This heat engine operates to reduce equator-to-pole temperature differences and is a primary balancing mechanism for climate on Earth. On today’s modern society wherein information is at our fingertips and technologies are being developed every day, the chances of human survival towards another ice age is greater than before with the utilization of technological advances that we have now. Information dissemination regarding the matter is easier with the use of the internet, education through other mass media like television and print and new technological inventions to prepare humans for the coming of the ice. Infrastructures such as innovative and mammoth engineering could be developed in such a way that it can repel much of the cold. Infrastructure can also be modified to make massive collective farm for growing food indoors possible; same goes with the idea of raising cattle and poultry indoors. Handy gadgets and tools could also make all the difference. Improve communication via mobile phones and PDAs, innovative means of transportation that can make use of ice or the air’s humidity as fuel, and as [source of energy](http://londongirl.hubpages.com/hub/Renewable-energy-a-guide-to-5-common-sources-of-sustainable-power).

#### Humans have survived an Ice AGE before

**Firth 7/27/10,** Technology Editor at New Scientist, “Humans survived ice age by sheltering in 'Garden of Eden', claim scientists,” <http://www.dailymail.co.uk/sciencetech/article-1297765/Last-humans-Earth-survived-Ice-Age-sheltering-Garden-Eden-claim-scientists.html> **AP**

Some scientists even believe that the human race's population may have fallen to just a few hundred individuals who managed to survive in one location. Professor Curtis Marean, of the Institute of Human Origins at Arizona State University discovered ancient human artifacts in the isolated caves around an area known as Pinnacle Point, South Africa. 'Shortly after Homo sapiens first evolved, the harsh climate conditions nearly extinguished our species,' said Professor Marean. 'Recent finds suggest the small population that gave rise to all humans alive today survived by exploiting a unique combination of resources along the southern coast of Africa.' Humans would have been able to survive because of rich vegetation that was available in the area. The sea would have also been a good source of food as currents carrying nutrients would have passed by the shore, bringing with them a plentiful supply of fish, the team will say in a new research paper. Professor Marean said the caves contain archaeological remains going back at least 164,000 years. Professor Chris Stringer, a human origins expert at the Natural History Museum in London, said he agreed with Professor Marean's views on the early evolution of intelligence.